

CLAIMS

1. A rotary compressor, comprising:

2 a shaft rotatable about an axis;
4 at least one compressor wheel mounted on said shaft for
4 rotation therewith and having an inlet end of relatively small diameter and
a radial discharge end of relatively large diameter;
6 a nominally donut-shaped intercooling heat exchanger centered
about said shaft and adjacent said turbine wheel, said heat exchanger
8 having heat exchange fluid flow paths in heat exchange relation with each
other including a compressed gas flow path and a coolant flow path, said
10 coolant flow path being bounded in part by a wall of a diameter at least as
great as said relatively large diameter;
12 a housing for said compressor wheel and said heat exchanger
and together with said wall defining a compressed gas directing space
14 extending from said radial discharge end to an entrance to said compressed
gas flow path; and
16 a plurality of flow straightening vanes thermally coupled to
said wall and extending across said compressed gas directing space so that
18 heat in said compressed gas may be rejected to said vanes and then to
coolant in said coolant flow path.

2 2. The rotary compressor of claim 1 wherein said wall is
generally radially extending and on an end of said heat exchanger closest to
said compressor wheel and includes a section of greater diameter than said
4 relatively large diameter, said vanes extending generally radially and being
aligned with said section.

2 3. The rotary compressor of claim 2 wherein said vanes are
mounted on said wall at said section.

2 4. The rotary compressor of claim 2 wherein said vanes are
thermally coupled to said section of said wall by metallurgical bonding.

2 5. The rotary compressor of claim 1 wherein said heat
exchanger includes plural pairs of plates, the plates of each pair being
centrally apertured and having a generally circular outer axially directed
4 peripheral wall and a generally circular inner axially directed peripheral wall
with a generally flat area extending between said peripheral walls and
6 radially directed flanges on each peripheral wall axially spaced from the flat
area of the corresponding plate, the flanges on the plates of each pair being
8 secured and sealed together to define a flattened nominally donut-shaped
unit defining annular flow parts of said coolant flow path, said pairs of
10 plates being alternatingly stacked with fin structures extending between
radially inner and outer peripheral walls to define radial flow parts of said
12 compressed gas flow paths, there being one of said units on each axial end
of said heat exchanger with the flat area of one of the plates of said one
14 unit defining said wall.

2 6. The rotary compressor of claim 5 wherein each fin structure
4 is a circular serpentine fin having circumferentially alternating crests
 and valleys with the crests thereof in heat exchange thermal contact with
 units between which each fin is located.

2 7. The rotary compressor of claim 6 wherein each of said
4 units includes a radially outwardly directed tab with the tab of each unit
6 being aligned with the tabs of each other unit throughout the stack, the
 tabs of each unit further extending radially outwardly past the serpentine
 fins and axially into sealed engagement with each other, two apertures in
 each tab establishing fluid communication between the units in the stack
 and a flow blocking portion extending across the flat areas of each plate of
 each unit between the radially inner peripheral walls and the radially outer
 wall of the tab and at a location between the two apertures of each tab.

2 8. A rotary compressor, comprising:
4 a shaft rotatable about an axis;
6 at least one compressor wheel mounted on said shaft for
8 rotation therewith and having an inlet end of relatively small diameter and
 a radial discharge end of relatively large diameter;
10 a nominally donut-shaped intercooling heat exchanger centered
 about said shaft and adjacent said turbine wheel, said heat exchanger
 having heat exchange fluid flow paths in heat exchange relation with each
 other including a compressed gas flow path and a coolant flow path, said
 coolant flow path being bounded in part by a wall of a diameter at least as

great as said relatively large diameter, said heat exchanger including plural
12 pairs of plates, the plates of each pair being centrally apertured and having
a generally circular outer axially directed peripheral wall and a generally
14 circular inner axially directed peripheral wall with a generally flat area ex-
tending between said peripheral walls, and radially directed flanges on each
16 peripheral wall axially spaced from the flat area of the corresponding plate,
the flanges on the plates of each pair being secured and sealed together to
18 define a flattened, nominally donut-shaped unit defining annular flow parts
of said coolant flow path, said pairs of plates being alternately stacked
20 with fin structures extending between said radially inner and outer periph-
eral walls defining radial flow parts of said compressed gas flow path, there
22 being one of said units on each axial end of said heat exchanger with the
flat area of one of the plates of said unit defining said wall, each said fin
24 structure being a circular serpentine fin having circumferentially alternating
crests and valleys with the crests thereof in heat exchange thermal contact
26 with units between which each fin is located, each of said units further
including inlet and outlet ports with the inlet and outlet ports of each unit
28 being aligned with and sealed to the inlet and outlet ports of each adjacent
unit in the stack;

30 inlet and outlet fixtures mounted and sealed to the inlet and
outlet of one of said units; and

32 a housing for said compressor wheel and said heat exchanger
and together with said wall defining a compressed air directing space ex-
34 tending from said radial discharge end to an entrance to said compressed
air path.

9. The rotary compressor of claim 8 including an additional
2 one of said compressor wheels in axially spaced relation on said shaft to
said at least one compressor wheel and there are two of said walls and
4 axially spaced from each other, one adjacent said discharge end of said at
least one compressor wheel and one adjacent the discharge end of said
6 additional compressor wheel.

10. The rotary compressor of claim 9 further including first
2 and second sets of flow straightening vanes, one set being mounted on one
of said walls in thermally coupled relation therewith and another set being
4 mounted on the other of said walls in thermally coupled relation therewith.

11. The rotary compressor of claim 9 wherein there are ser-
2 pentine fins on each of said two walls, one adjacent the discharge end of
each of said compressor wheels.

12. The rotary compressor of claim 8 wherein each of said
2 units includes a radially outwardly directed tab with the tab of each unit
being aligned with the tabs of the other units throughout said stack, the tab
4 of each further extending radially outwardly past the serpentine fins, said
inlet and outlet ports including aligned apertures in said tabs.

13. The rotary compressor of claim 12 wherein said ports
2 further include axially directed collars surrounding said aligned apertures
4 and engaging and sealed to collars of the adjacent tabs and establishing
6 fluid communication between the apertures, and thus the units, in the
stack, and flow blocking partition extending across flat areas of each plate
of each unit between the radially inner and outer peripheral walls thereof at
a location between said inlet ports and said outlet ports.

14. The rotary compressor of claim 12 where each said tab
2 extends axially into sealed engagement with adjacent tabs about said aper-
tures.

15. The rotary compressor of claim 14 wherein each said tab
2 extends axially into said sealed engagement by means of axially directed
collars surrounding said aligned apertures.

16. The rotary compressor of claim 15 wherein adjacent
2 sealed collars telescope into one another.

17. The rotary compressor of claim 12 wherein each said unit
2 includes two of said tabs, said two tabs being circumferentially spaced
4 about said circular outer axially directed peripheral wall, and said inlet parts
are in one of the tabs of each said unit and said outlet ports are in the other
of the tabs of each said unit.

18. The rotary compressor of claim 8 further including at
2 least one circumferential flow director within each said unit at a location
4 radially inward of said outer axially directed peripheral wall and radially
6 outward of said inner axially directed peripheral wall, said outlet ports being
8 in fluid communication with a first space between one of said peripheral
walls and said flow director and said inlet ports being in fluid communica-
tion with a second space between the other of said peripheral walls and
said flow director.

19. The rotary compressor of claim 18 further including a port
2 in each of said flow directors at a location remote from said inlet and outlet
4 ports establishing fluid communication between said first and second
4 spaces.

20. A rotary compressor, comprising:
2 a shaft rotatable about an axis;
4 at least one compressor wheel mounted on said shaft for
6 rotation therewith and having an inlet end of relatively small diameter and
8 a radial discharge end of relatively large diameter;
10 a nominally donut-shaped intercooling heat exchanger centered
about said shaft and adjacent said turbine wheel, said heat exchanger
having heat exchange fluid flow paths in heat exchange relation with each
other including a compressed gas flow path and a coolant flow path, said
coolant flow path being bounded in part by a wall of a diameter at least as
great as said relatively large diameter, said heat exchanger including plural

12 pairs of plates, the plates of each pair being centrally apertured and having
a generally circular outer axially directed peripheral wall and a generally
14 circular inner axially directed peripheral wall with a generally flat area ex-
tending between said peripheral walls, and radially directed flanges on each
16 peripheral wall axially spaced from the flat area of the corresponding plate,
the flanges on the plates of each pair being secured and sealed together to
18 define a flattened, nominally donut-shaped unit defining annular flow parts
of said coolant flow path, said pairs of plates being alternately stacked
20 with fin structures extending between said radially inner and outer periph-
eral walls defining radial flow parts of said compressed gas flow path, there
22 being one of said units on each axial end of said heat exchanger with the
flat area of one of the plates of said unit defining said wall, each said fin
24 structure being a circular serpentine fin having circumferentially alternating
crests and valleys with the crests thereof in heat exchange thermal contact
26 with units between which each fin is located, each of said units including
aligned inlet and outlet ports for the annular flow parts of said coolant flow
28 path, said inlet and outlet ports including aligned apertures in said plates.

21. The rotary compressor of claim 20 wherein said apertures
2 are surrounded by axially directed collars, aligned ones of said collars being
sealed to one another.

22. The rotary compressor of claim 21 wherein said collars
2 are integral with their respective plates and telescope into one another.

23. The rotary compressor of claim 22 further including flow
2 directors in each of said units separating said inlet and outlet ports to cause
flow through said annular flow parts.

24. The rotary compressor of claim 23 wherein said flow
2 directors are circumferentially directed.

25. The rotary compressor of claim 23 wherein said flow
2 directors are radially directed.

26. The rotary compressor of claim 20 wherein one of said
2 units additionally includes a radially directed tab and inlet and outlet fixture
4 mounted to said tab and being respectively in fluid communication with the
inlet and outlet ports in said one unit.

27. The rotary compressor of claim 26 wherein said one unit
2 has an annular flow part of greater cross-sectional area than the annular
flow part of the other of said units.